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Description

Highly abrasion-resistant tape for binding cable trees in motor vehicles

This application is a 371 of PCT/EP2005/002300, filed March 4, 2005, which claims foreign priority benefit under 35 U.S.C. § 119 of the German Patent Application No. 10 2004 011 223.1 filed March 4, 2004.

The invention relates to a highly abrasion-resistant tape which can be used in particular for bandaging cable harnesses in automobiles.

In many segments of industry, bundles composed of a multiplicity of electrical lines are wrapped either before installation or when already mounted, in order to reduce the space taken up by the bundle of lines, by means of bandaging, and also to obtain protective functions. With sheet adhesive tapes a certain protection against ingress of liquid is achieved; with airy and bulky adhesive tapes based on thick nonwovens or foam backings, insulating properties are obtained; and when stable, abrasion-resistant backing materials are used a protective function against scuffing and rubbing is achieved.

Particularly the protective function with respect to scuffing, rubbing, grinding on sharp edges and burrs, etc., summarized here under the concept of abrasion resistance, is increasing in significance. The sharp edges, burrs and weld points, etc., that come about as a result of production operations are increasingly not having their sharpness removed by complicated post-production work, since such work entails an additional operation and increased costs. This is so in particular in the case of the untreated bodies in the automobile industry, but also in other segments too, such as in the case of washing machines, vibrating machines such as compressors and the like, for example. Cable strands which run in such segments and which are scuffed by vibration, relative movements and the like on such sharp points are therefore at potential risk of destruction

of the protective sheath. This protective sheath may be the additional wound bandaging, or else may be the insulation around the copper cable itself. In that case the result would be a short circuit with complete functional failure and destruction of electrical/electronic components, possibly going as far as a fire, with the attendant risks of damage to equipment and people.

In order to minimize potential hazards of this kind it is the case not only that normal wrapping tapes are used to bandage the cable strands at critical points but also that additional precautions are taken. Either specialty adhesive tapes are used or particular protective components are employed. These components may, for example, be cable ducts made of wear-resistant polymers such as polyamide or fluted tubes or braided hoses of polyester or nylon, all components which are unfavorable from the standpoints of cost, separate logistics and complexity of handling during assembly. In the case of the assembly of fluted tubes and cable ducts, for example, considerable effort is required for attaching the lengthy tube systems and fixing them reliably to the cable bundle and/or to the body, in order to prevent slipping. Additionally, separate measures may be necessary for preventing rattling, since the lines in the tube systems rarely lie flush against them and in the event of vibrations they therefore produce rattling noises with the hard materials of the tubes.

Specialty adhesive tapes as well are used in segments involving increased abrasion protection and scuff protection. Adhesive tapes for the wrapping of cable sets or similar elongated systems with additional functionalities are known in the prior art and in some cases are also utilized commercially:

EP 1 136 535 A1 includes in its description a multilayer adhesive tape with a soundproofing effect, composed of a velour and a nontextile interply, said interply being either a film or a directly applied, nonadhesive plastic or foam coating. This interlayer serves to stabilize the velour against warping and as a barrier layer for preventing penetration of the adhesive, applied by knife coating, into the velour backing. With an adhesive tape of this kind the desired abrasion protection is low and is achieved solely by the outer layer of the velour and the outwardly pointing velour loops.

Sound insulation is the sole purpose of the adhesive tape described in DE 199 10 730 A1, which is composed of a laminate, a sound insulation layer (velour or foam) and a web, produced using hotmelt adhesive, melting powder or a transfer fixative. The use of the very expensive velour backing comprising the polymer material polyester or polyamide is also employed in other applications which describe adhesive tapes with a pronounced antirattle function (DE 299 00 294 U1, DE 299 16 616 U1 and DE 101 02 927 A1). In all cases the resulting adhesive tapes have a high price and in terms of abrasion protection do not meet very high requirements.

A construction similar to that of EP 1 136 535 A1 is possessed by DE 101 49 975 A1. In this case an adhesive tape for protecting articles against abrasion and rattling is described that has a two-layer construction comprising a textile layer and a film applied by calendering. Woven or web, as the textile layer, and PVC films in particular are firmly and permanently connected to one another here, without the use of adhesives, by calendering under pressure and heat. The textile layer is arranged facing away from the article to be protected.

WO 00/13894 A1 describes a scuff protection device as edge protection for sharp-edged components such as sheet steel bodywork burrs, the scuff protection being adhered in such a manner as to engage around such areas. The scuff protection is composed of a textile backing layer (made of velour or a needle felt, for example) and of a protective film, preferably made of thermoplastic polyurethane polymer, which is applied on the side of the scuffing sides, and also of an adhesive layer which is applied on the side of the component and has a release paper lining. Textile backing layer and protective film are joined to one another via a thin adhesive bond, the adhesive being applied only in selected areas in the form of a heat-activable adhesive web, powder or film. This complicated assembly is lined with release paper, used in appropriate cut-to-size shapes, and is therefore unsuitable for the general protective wrapping of cable harnesses. The protective device of this invention does not actively protect the cable harness; instead, where needed, sharp-edged parts are locally masked from their surroundings as a kind of passive cable loom protection.

DE 100 42 732 A1 describes an adhesive tape for the spiral wrapping of elongate products such as cable looms, for example, where a stripe coating which does not extend over the full area of the backing, preferably a textile backing, produces reduced adhesion of the wrapping tape to the lines and hence improved mobility and bendability of the cable loom as a whole. Inventive adhesive tapes of that kind, however, do not offer any particular abrasion protection, but serve solely for the flexibilization of the cable loom.

An adhesive tape with a combination of noise reduction and frictional-stress protection properties is described in DE 101 13 425 A1. Even at the required basis mass of the web backing with vertical pole folds, of more than 200 g/m², the protective effects obtained are only in the middle range for attenuation, and in particular against abrasion, as was already known even from EP 0 995 782 A1 and also EP 0 995 783 A1. Similar comments are also true of DE 100 39 983 A1, which in one specific embodiment describes a textile assembly composed of a scuff-resistant web and a textile sheetlike structure, which is produced without the use of a laminating adhesive or the like, solely by hydroentanglement. While the textile sheetlike structure imparts additional attenuating or reinforcing properties to the assembly, the abrasion resistances for the scuff-resistant hydroentangled base web, composed of stable fibers, is seen as being fairly low for a basis mass of not more than 200 g/m². Further references, and particularly specific details regarding scuff resistances, are absent from all of the protective rights referred to above.

Besides the stitchbonded web mentioned in the cited publication, there are further backings which are used in adhesive tapes for cable harness bandaging.

DE 44 42 092 C1 describes one such stitchbond-based adhesive tape, which is coated on the reverse of the backing. DE 44 42 093 C1 is based on the use of a web as backing for an adhesive tape, the web being formed by the formation of loops from the fibers of the web reinforced cross-laid fiber web, in other words a web which is known to the skilled worker under the name Malifleece. DE 44 42 507 C1 discloses an adhesive tape for cable bandaging but bases it on so-called Kunit or Multiknit webs.

One extremely complicated and high-cost multilayer assembly is disclosed by EP 0 886 357 A1 and EP 0 886 358 A1. In that case a PET spunbonded web, a PET formed-loop knit and, where appropriate, a felt or foam ply are each bonded to a laminating layer. This assembly of up to five layers, which is already complicated, is additionally provided partially with the two necessary components of a touch-and-close fastening system and one or more self-adhesive strips lined by protective paper. From an economic standpoint, systems of this kind with a high abrasion protection function are practicable only at a few selected sites, but not as general wrapping tapes for cable looms or other elongated articles.

With similar complexity, DE 298 23 462 EU1 describes, as protective cladding for preventing rattling noises for line systems, a wrapping tape featuring a backing assembly comprising at least two textile layers, this tape being said additionally to exhibit high abrasion resistance and chafing resistance. The outer layer is composed of a warp knit velour with highly raised velour loops, which in certain areas is connected to a web, preferably a needlefelt web, by means of a heat-activable laminating adhesive, with a coat weight of from 10 to 30 g/m². At about 1.5 to 4 mm, the sheathing is too thick, when applied, for numerous automobile applications and, as a result, cannot be used at narrow points.

In summary it is possible to observe that there are a multiplicity of attempted solutions in which, preferably, the very costly textile backing material, velour, is responsible, in conjunction with at least one further textile or nontextile sheetlike structure, for the particular abrasion protection and/or antirattle protection (described in detail in DE 298 23 462 EU1). The backing assembly is produced either without an adhesive layer or else by means of a particular heat-activable laminating adhesive, frequently used only in selected areas. The sole purpose of self-adhesive compositions is to produce an adhesive tape, as a separate layer from this backing assembly. Owing to the use of the knit velour, adhesive tapes of this kind are not only very expensive but also, as a result of the loop structure, are so thick that specialty wrapping tapes of this kind cannot be used

in the normal overlapping spiral wrapping or in longitudinal sheathing, owing to the scant installation spaces that are available.

It is an object of the invention to achieve a marked improvement over the state of the art and to provide a tape which combines the possibility for bandaging individual lines to form cable looms with high protection against mechanical damage caused by scuffing and rubbing on sharp edges, burrs, weld spots, etc. This tape, preferably adhesive tape, ought to be suitable not only for the standard wrapping techniques with overlapping or open spiral wrapping around the bundle of lines but also for longitudinal application by means of applicators, such as are described in EP 1 008 152 A1, for example, or in the form of special processing versions, particularly in accordance with DE 100 36 805 A1. In the special form with only striplike adhesive coating in the longitudinal direction at the edges of the backing material, in accordance with DE 100 42 732 A1, the backing material of the invention ought also to lead to innovative, highly abrasion-resistant cable wrapping tapes which combine bandaging function and abrasion protection function in the preferred adhesive tape.

An established method of determining the abrasion resistance of protection systems in vehicle electrics is the international standard ISO 6722, section 9.3 “scrape abrasion test” (issued April 2002). In this test the test specimen (for example, the insulated copper line or else the wrapping tape adhered to a metal mandrel) is exposed to a thin steel wire with defined scrape geometries and under a defined weight load, until the protective sheath has been rubbed through and, as a result of short circuiting, the counter which runs at the same time comes to a stop.

Unless indicated otherwise, all details relating to abrasion resistance refer to this ISO 6722 method. The adhesive tape is for this purpose adhered in a single ply in the longitudinal direction on a metal mandrel 10 mm in diameter; the scraping motion takes place centrally on the adhesive tape under a weight load of 7 N. The rubbing body used is a steel wire complying with ISO 8458-2, 0.45 mm in diameter. The parameter for the abrasion resistance that is reported is the number of scrapes until short circuiting. In cases of very high scuff resistances, the mass that is applied can be increased in order to

reduce the measurement time and the number of scrapes. In this case an applied weight of 10 N has proven favorable.

The invention accordingly provides a highly abrasion-resistant tape for bandaging cable harnesses, in particular in automobiles, comprising a backing having a first outer layer A and a second outer layer B, with

an interlayer C located between and firmly connected, in each case, over its entire surface, to the outer layers A and B,

the outer layers A and B being composed of a woven fabric or formed-loop knit,

the interlayer C being composed of a viscoelastic adhesive, preferably self-adhesive, or a double-sided adhesive tape.

In a first advantageous embodiment of the invention the viscoelastic adhesive or the adhesives for the double-sided adhesive tape are self-adhesive compounds based on natural rubber, synthetic rubber, polyacrylates or silicones.

Surprisingly it is found that when a multi-ply system is produced in accordance with the invention the abrasion resistance of the overall assembly turns out to be much higher than the sum of the abrasion resistances of the individual plies, thereby achieving a considerable increase in the protective effect against rubbing and scuffing exposures without the need to take special protection measures. With the inventive construction of the tape it is possible to produce a combination of the bandaging possibilities of a normal wrapping tape with the abrasion protection of specialty systems such as TwistTubes®, braided hoses, flexible corrugated tubes and the like. For this purpose it is necessary to select the kind of composite construction for the backing material that is described below, and in this context the stated embodiments should be regarded only as examples.

Preferably the abrasion resistance of the backing (measured in accordance with ISO 6722, Section 9.3 "Scrape abrasion resistance") is at least 150% of the sum of the abrasion resistances of the individual plies.

The system in question is a multi-ply system composed of two identical or different outer layers A and B, at least one per se featuring favorable abrasion resistance, such as, for example, films, nonwovens, formed-loop knits, wovens, velour, etc., and which is composed of corresponding materials, and at least one interlayer C, which firstly provides the permanent connection between the outer layers A and B but is also designed such that it is able to absorb and "eliminate" forces and energies which occur in the course of rubbing and scuffing motions. This specific energy elimination may denote the mechanical energy being passed onto other parts in the tape or its surroundings or else may denote its at least partial conversion into heat or the like. This prevents the original mechanical energy destroying the outer layers, by being converted into other forms of energy or else transmitted to areas of the tape at which it causes no damage or else lesser damage than directly on the outer layers. Accordingly the functional capacity of the tape as a wrapping tape and protective sheath is prolonged, so that in many cases there is no need for additional, expensive and labor-intensive protection systems.

In the prior art, use is also made in many cases of multi-ply composite systems in which the interlayer C does not effect the aforementioned functionality but is only intended to produce the connection between two plies A and B. The interlayers are typical laminating adhesives, in the form for example of heat-activable adhesive webs or in similar forms. These systems are characterized in that they are applied at very low grammages/thicknesses in order, by adhesion to the two plies A and B, to produce a permanent and solid contact, without significantly increasing the production costs. After they have cooled, heat-activable thermoplastics of this kind do not have self-adhesive properties. The coatweights for laminating adhesives of this kind are normally situated within the lower region of the range from 10 to 30 g/m², whereas at coatweights in the upper range such composites can become boardy and possibly too stiff for a wrapping tape. In many cases, deliberately or as an inevitable result of choice of the laminating adhesive technology, only partial formation of a connection between the plies is obtained. Reference may be made here, by way of example, to the abrasion protection system composed of a nylon warp velour and a polyester needle felt in accordance with VW standard part number N 908 809, where the backing assembly is laminated together by a nonself-adhesive heat-activable nylon spun bonded web with a basis mass of 17 g/m².

In contrast, the inventive interlayer C is characterized in that it has a considerably greater thickness and/or mass between the outer plies A and B and in terms of the material used and/or the construction is capable of dissipating or converting externally incident forces and energies from friction, scuffing, vibrations, etc. Particularly suitable here are rubber-elastic as viscoelastic layers such as thick adhesive layers of natural or synthetic rubber or polyacrylates. Generally speaking, viscoelastic systems such as are used in self-adhesive compositions are particularly suitable for use as an interlayer of this kind.

Even systems which are already of multi-ply construction per se are suitable as interlayers according to the invention. Known double-sided adhesive tapes for carpet laying, for example, have not only an internal sheetlike support backing but also thick adhesive layers on both outer sides. Suitable backings, as well as films, foamed systems, nonwovens, formed-loop knits and parallelized filaments, include open woven fabrics in particular. Conceivable adhesives include all known systems such as acrylates, silicones, synthetic rubbers and also, in particular, natural rubber and formulations derived therefrom. Where double-sided adhesive tapes of this kind, such as the known carpet-laying tape tesafix® 4964, for example, are placed between the outer layers A and B, a significant increase is obtained in the abrasion resistance, which is markedly higher than the sum of the individual layers.

Where the adhesive tapes selected for the interlayer C are double-sided adhesive tapes which have, as a support backing centrally between the two outer layers of adhesive, a coherent, impervious sheetlike structure such as, for example, a flexible film, the highly abrasion-resistant wrapping tape of the invention acquires an additional property, which in certain cases is also advantageous on its own and can lead to the use of the product.
Particularly in areas in which strands of lead can come into contact with aggressive chemicals, the bandaging or sheathing thereof with an adhesive tape of this kind would result in a substantial barrier effect with respect to said chemicals. The film acts as a barrier, for example, to service fluids such as gasoline, lubricating oils, antifreeze, and the like in the engine compartment of motor vehicles. This is advantageous because, as is known, quite a few of these service fluids can damage the internally located lead

insulation. The coherent barrier layer can either be introduced as a backing film via the double-sided adhesive tape into the interlayer or else produced separately during the operation of producing the composite backing, by producing the interlayer in two plies from the same or different layers of adhesive, an appropriate film being inserted between these two plies.

For the films it is possible to use resistant polymers such as PVC, polyethylene, polypropylene, polyesters, and other high-performance polymers; in particular, elastic and flexible films in a thickness of 5 to 150 μm, especially 15 to 50 μm, are suitable for this purpose.

Without these figures being regarded as a sharp exclusion limit, the entire interlayer C ought to have a thickness of about 0.05 to 2 mm, with interply thicknesses of from 0.05 to 1.0 mm being appropriate in view of the actual upper limit on the thickness of the overall adhesive tape for bandaging applications of elongated products such as cable strands, for example, which in the normal case is about 1 to 1.5 mm.

For an inventive improvement in abrasion resistance, suitable basis masses for the interlayer C are from 40 to 600 g/m^2, in particular from 50 to 300 g/m^2.

Backing assemblies of this kind in accordance with the invention are not only notable for very high abrasion and scuff resistances but also have soundproofing properties, so that depending on the field of use they can be used not only as a protection system against mechanical loads but also as an antirattle tape. Specifically with cable harnesses in machines or automobiles it is frequently necessary to combine abrasion protection directly with antirattle requirements. A moving cable strand may on the one hand become scuffed on sharp edges and burrs but may also generate rattling noises in the case of vibrations and counterstriking. If the wrapping tapes used for cable bandaging are then capable of actively suppressing or reducing the occurrence of noise, there is no need for additional, high-cost soundproofing measures.

The backing assemblies of the invention, with a thick interlayer of viscoelastic adhesive and/or a double-sided adhesive tape, result in a certain sound damping and noise suppression, which can be boosted by additionally integrating in the interlayer C a “voluminous” sheetlike structure such as, for example, a nonwoven, formed-loop knit, foamed film or foam.

In a further advantageous embodiment of the invention the backing is coated at least on one side with a self-adhesive compound.

This coating takes place on the open side of the outer layer A or the open side of the outer layer B.

In order to produce a self-adhesive tape from the assembly backing it is possible to have recourse to any of the known adhesive systems. Besides natural rubber or synthetic rubber based adhesives it is also possible to use silicone adhesives and, in particular, polyacrylate adhesives. On account of their particular suitability as the adhesive for wrapping tapes for automobile cable sets, with respect to the absence of fogging and also the outstanding compatibility with PVC and PVC-free core insulation, preference is given to solvent-free acrylate hotmelts, as described in more detail in DE 198 07 752 A1 and also in DE 100 11 788 A1. The adhesive coat weights should be adapted to the respective assembly systems in respect of the roughness and absorbency of the surface to be coated, and are in the range between 40 to 100 g/m² for smooth, nonabsorbent outer layers or else up to 300 g/m² for open, textured outer layers, with 50 to 150 g/m² being regarded as sufficient in the normal case. As coating technology for backing materials of this kind it is possible to have recourse to known systems, with appropriate processes for open, absorbent textiles being those which allow adhesives of high viscosity to be applied without pressure, such as the nozzle coating of hotmelt adhesives or their application by transfer from an antiadhesive carrier cloth or release liner to the backing assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in greater detail with reference to the drawings, wherein:

Figure 1 is a schematic depicting a first backing assembly; and

Figure 2 is a schematic depicting a second and a third backing assembly.

One advantageous form of a backing assembly of the invention can be produced from two outer layers and a thick, viscoelastic interlayer by laminating together two identical or different backing materials, coated on one side with adhesive, or in different widths, with the adhesive sides facing one another and with an offset, so that at the edges of each side a narrow strip of adhesive remains open and tacky. Constructions of this kind have already been described in DE 100 42 732 A1 or DE 37 33 841 A1, although not for use in highly abrasion-resistant adhesive tapes. In the simplest case, therefore, it is possible to employ two suitable standard adhesive tapes which are combined in the abovementioned configuration and which thereby form a highly abrasion-resistant adhesive tape which is suitable in particular for the longitudinal sheathing of elongate products in accordance with DE 100 36 805 A1, as shown in Fig. 1.

If the two adhesive strips at the edge are to be oriented toward the same side, a further possibility is a slightly altered, simpler construction, which leads, however, to a reduction in the abrasion protection function, since the viscoelastic interlayer is reduced in its power, as shown in Fig. 2. Which of the two versions is used depends in each specific case on the economic and technical requirements.

The narrower backing strip for partial lining may therefore, as in the above case, be an adhesive tape made up of backing and self-adhesive compound, or else just a sheetlike structure such as a film or a textile backing, if the self-adhesive layer of the wide strip is already sufficiently dimensioned.

Through an appropriate selection of the two components, in other words, in this case, the two self-adhesive tapes, the adhesive tape can be varied within wide ranges for

longitudinal sheathing applications. By way of the type of backing materials used it is possible to select the abrasion resistance and thermal stability, damping properties and also color and appearance of the outer ply. The interlayer of the invention is achieved through the nature and amount of the respective adhesive tape coating.

The inventive concept therefore further embraces an elongate product, such as a cable harness in particular, wrapped with an adhesive tape of the invention, and also a vehicle comprising the wrapped elongate product.

As outer layers suitability is possessed in principle by all sheetlike structures which offer a suitable scuff resistance and surface area as to be appropriate for applications of this kind in the automobile segment, especially woven fabrics, formed-loop knitted fabrics, velours, nonwovens and similar textile materials. Fabrics which have proven particularly suitable are closely woven filament fabrics of polyester or nylon, or else of glass fibers or high-performance plastics such as carbon fibers, with a weave construction of 40 to 50 threads per cm in the warp direction and 20 to 30 threads per cm in the fill direction. Woven PET fabrics of this kind with a basis weight of from 70 to 150 g/m^2 have already been used for some time in wrapping tapes in the engine compartment, are temperature- and age-resistant and are known to have a mean abrasion resistance of approximately 300 to 1000 scrape cycles in accordance with ISO 6722 (mandrel diameter 10 mm, 10 N applied weight, 0.45 mm steel wire) (see table 1):

Adhesive tape	Abrasion resistance	
Woven PET fabric (130 g/m^2) with rubber compound	500	to 1000 cycles
Stitchbonded PET web (80 g/m^2) with rubber compound	20	to 100 cycles
0.1 µm PVC film with rubber compound	1	to 50 cycles
TwistTube = braided PET hose (without adhesive)	2000	to 5000 cycles

Table 1

If it is assumed in a first approximation that when a woven filament fabric of this kind is used in a double ply with from 5 to 30 g/m^2 of a (partially applied) laminating adhesive in between the abrasion resistance is doubled, then the effect when using an interply of 50 g/m² or more of a suitable viscoelastic adhesive layer - a UV-crosslinked hotmelt acrylate adhesive or a natural rubber adhesive, for example - is surprisingly positive.

The abrasion resistance of a composite system of this kind is significantly higher than the sum of the outer plies (table 2).

	Construction of the backing assembly from 2 woven PET filament fabrics (125 g/m²) and as interlayer C	Abrasion resistance (7 N applied weight)
A	none	5130 cycles
B	30 g/m² laminating adhesive	5310 cycles
C	120 g/m² acrylate hotmelt adhesive	12 000 cycles
D	260 g/m² natural rubber adhesive	> 20 000 cycles

Table 2

For the measurement of version 1, two plies of the above-described woven PET filament fabric are fixed mechanically on the abrasion measurement apparatus and measured without an additional laminating adhesive. The use of the laminating adhesive in the case of version B produces no significant increase in abrasion resistance as compared with the adhesive-free base version 1.

Only when an interlayer of the invention is employed - in this example 120 g/m² of a UV-crosslinked acrylate adhesive - is there an increase in the abrasion levels by more than 100%. A construction of this kind as version 3 can be realized industrially without great effort by laminating together two single-sided woven tapes each constructed from a woven PET backing with an adhesive coat weight of 60 g/m². The result is the inventive backing assembly composed of the two woven outer layers and 2 × 60 g/m² = 120 g/m² of

adhesive as an interlayer in between. The woven PET tape coated on one side with 60 g/m^2 of acrylate adhesive has an abrasion resistance of 1800 cycles, and so for the backing assembly according to version 3 the corresponding abrasion value that could have been expected was 3600 cycles. In actual fact, however, it is possible to increase the abrasion resistance by more than 300%.

In version 4 the interlayer used is a commercially available double-sided carpet-laying tape (tesafix ® 4964) consisting of about 250 g/m^2 of a resin-modified natural rubber adhesive and a 110 g/m^2 woven spun rayon fabric as central backing material. When subjected to abrasion measurement the double-sided adhesive tape gives a value of only about 500 cycles; in its function as an interlayer for the two woven PET outer layers, the abrasion measurement on version 4 was discontinued after 20 000 cycles without the backing assembly having been abraded right through. In this combination as well the scuff resistance is improved by more than 300% in comparison with the sum of the individual values.

The absolute gain in abrasion resistance is even greater if a suitable further backing is additionally installed between the two woven PET fabric outer plies.
These may be films, foamed films, foams and in particular textile backings. With version 3 from table 2 as the basis it is possible to produce further highly abrasion-resistant backing assemblies if a textile backing is inserted centrally into the interlayer of 120 g/m^2 self-adhesive composition.

In technical terms this variant can also be realized in an extremely simple way by laminating the textile backing in question between two plies of the above-described woven PET tape with 60 g/m^2 self-adhesive composition (table 3). Since the two outer layers are already coated with sufficient self-adhesive composition, there is no need for separate fixing of the textile ply. The self-adhesive composition therefore fulfills the dual function of being an abrasion-promoting interlayer and of being a fixing aid for the centrally introduced textile.

	Construction of the backing assembly from 2 outer plies of a woven PET fabric (125 g/m²) and 60 g/m² acrylate adhesive and a textile backing	Abrasion resistances	
		7 N	10 N
		Applied weight	
3	none	12 000 cycles	5100 cycles
5	PET staple fiber web, 60 g/m²	> 20 000 cycles	--------
6	Woven filament fabric, 60 g/m²	> 20 000 cycles	--------
7	Nylon fabric, 75 g/m²	34 400 cycles	
8	PET loop fabric, 230 g/m²	> 50 000 cycles	
9	PET Multiknit, 320 g/m²	--------	> 23 000 cycles

Table 3

Even nonwovens which lack inherent abrasion resistance, such as, for example, a hydroentangled PET staple fiber web of 60 g/m² basis weight, which on its own is abraded right through after just 140 cycles, improves the abrasion resistance of the overall assembly according to version 5 from 12 000 to more than 20 000 cycles. When inherently stable textile backings are used centrally in the backing assembly (variants 7 to 9 with a loop fabric, a nylon fabric and a Multiknit nonwoven, respectively), the abrasion measurement with an applied weight of 7 N is already reaching its limits. An increase in the scuffing load by 10 N applied weight produces more than 23 000 cycles even for variant 9, however. This puts assemblies of this kind in the regions which are measured for special abrasion protection components on cable looms, such as braided hoses, fluted tubes, etc., and which offer maximum protection. In particular, textiles made from toughened elastic or wear-resistant materials, such as polyamide, carbon fibers or glass, for example, lead to further improvements in abrasion protection.

From the exemplary backing assemblies of tables 2 and 3 it is clear that, with a corresponding construction of the backing material in accordance with the invention, very

high abrasion and scuff resistances are achievable, so that adhesive tapes produced from such backings offer an attractive combination of bandaging and wrapping tape with integrated abrasion protection. Adhesive tapes of this kind are appropriate primarily for the spiral and longitudinal sheathing of electrical lines to form cable sets when the latter are used on a long-term basis in areas where scuffing and vibration are hazards. In view of their excellent abrasion protection effect, however, backing assemblies of this kind possess general suitability as protective systems against scuffing and rubbing stresses. The provision of self-adhesion, to form an adhesive tape, is not absolutely necessary if the positioning and fixing of the system at the area to be protected is achieved in another way: for example, by means of a stitched hose or a hose with touch-and-close fastening around an elongate product requiring protection.

The examples described below indicate to the skilled worker how such assembly backings are produced.

Example 1

For the outer layer a woven polyester filament fabric with a basis mass of 125 g/m² is chosen which has 45 threads per cm in the warp direction and 25 threads per cm in the fill direction. The filament has a linear density of 167 dtex. The ultimate tensile strength measured is 220 N/cm in the breaking test with a breaking elongation of 32% in the warp direction. This polyester fabric is coated onto the textile backing under pressure and temperature by transferring 60 g/m² of a UV-crosslinked acrylate hotmelt (BASF acResin 258) from release paper, to form a single-sided woven adhesive tape.

a) for the backing assembly according to version 3 from table 2, two plies of this single-sided woven adhesive tape are laminated to one another with the adhesive. A self-adhesive wrapping tape can be produced from this nonadhesive backing assembly by coating with about 100 g/m² of the same acrylate hotmelt, with the possibility of controlling the adhesive properties which are important for the subsequent application, such as adhesion, cohesion, and tack, within wide ranges by way of the extent of UV crosslinking.

b) as in example 1 a), but in the course of the lamination of the two single-sided outer plies a 0.25 mm thick hydroentangled PET staple fiber web with a basis mass of 60 g/m² is laminated in as a textile backing between the adhesive layers.

The abrasion values are listed in tables 2 and 3 as versions 3 and 5.

Example 2

The woven PET filament fabric described in example 1 is used as the outer plies. As the viscoelastic interlayer the double-sided adhesive tape tesafix ® 4964 is chosen, which is composed of a woven spun rayon fabric of about 110 g/m² with on either side about 120 to 130 g/m² of a resin-modified natural rubber adhesive. Laminating this system under pressure produces a highly abrasion-resistant assembly backing which can be utilized as a backing for self-adhesive tapes or else, without an adhesive coating, can be used as abrasion protection (version 4 from table 2).

Counterexample

The critical effect of the interlayer according to the invention in the increase in abrasion resistance is evident from the following counterexample.

If the woven PET filament fabrics described in example 1 are used as outer layers but only a minimal amount of a heat-activable, thermoplastic laminating adhesive is used to form the assembly, the abrasion values which result from the overall assembly correspond virtually only to the sum of the two outer layers (version 2 from table 2). Additional protection is therefore not achieved.